CLAIMS

1. Charged particle beam device, comprising:

an emitter (12) for emitting charged particles;

an aperture arrangement (26; 86) with at least one aperture (36) for blocking a part of the emitted charged particles, whereby the aperture arrangement forms a multi-area sub-beam charged particle beam

with a cross-section-area and a cross-section-circumference,

whereby a ratio between the cross-section-circumference and the cross-section-area is increased by at least 15% as compared to the ratio between a cross-section-circumference and a cross-section-area of a circular beam with the same cross-section-area as the multi-area sub-beam charged particle beam;

an objective lens (18) for focusing the multi-area sub-beam charged particle beam onto the same location within the focal plane.

2. Device according to claim 1, whereby

the ratio between the circumference of the cross-section and the cross-section-area is increased by at least 40% as compared to the ratio between the circumference of the cross-section and the cross-section-area of a circular beam with the same cross-section-area.

3. Device according to any of claims 1 to 2, whereby

the aperture arrangement (26; 86a,b) with at least one aperture comprises at least two apertures (36), whereby the multi-area sub-beam charged particle beam is provided as at least two independent charged particle beams.

4. Device according to any of claims 1 to 3, whereby

the aperture arrangement (26; 86) with at least one aperture (36) forms a multi-area sub-beam charged particle beam with cross-like shape.

5. Charged particle beam device, comprising:

an emitter (12) for emitting charged particles;

an aperture arrangement (26; 86) with at least one aperture (36) for blocking a part of the emitted charged particles, whereby the aperture arrangement forms a multi-area sub-beam charged particle beam with a cross-like shape;

an objective lens (18) for focusing the at least two independent charged particle beams onto the same location within the focal plane.

6. Device according to claim 5, whereby

the multi-area sub-beam charged particle beam is provided with a 4-fold symmetry around an optical axis of the device.

7. Device according to any of claims 5 to 6, whereby

the aperture arrangement (26; 86a,b) with at least one aperture comprises at least two apertures (36), whereby the multi-area sub-beam charged particle beam is provided as at least two independent charged particle beams.

8. Charged particle beam device, comprising:

an emitter (12) for emitting charged particles;

an aperture arrangement (26; 86a,b) with at least one aperture (36) for separating the emitted charged particles into at least two independent charged particle beams;

an objective lens (18) for focusing the at least two independent charged particle beams onto the same location within the focal plane.

9. Device according to claim 8, whereby

the aperture arrangement forms a multi-area sub-beam charged particle beam with a cross-like shape.

10. Device according to any of claims 1 to 9, whereby

the emitter is a quasi spot-like emitter with a source diameter below 200 nm, preferably below 100 nm.

11. Device according to any of claims 3, 4 or 8 to 10, whereby

the at least two independent charged particle beams have a distance (D) with respect to each other such that no interaction occurs between the at least two independent charged particle beams.

12. Device according to any of claims 3, 4 or 8 to 11, whereby

the at least two independent charged particle beams have a distance (D) with respect to each other, whereby the distance has about the same dimension as the diameter of the at least two apertures (36).

13. Device according to claims 3, 4 or 8 to 12, whereby

the at least two apertures (36) are formed by a segmented annular aperture.

14. Device according to any of claims 3, 4 or 8 to 13, whereby

the at least two apertures (36) have an elongated shape with a long axis and short axis, whereby the long axis is arranged radially with respect to an optical axis (1) of the charged particle beam device.

15. Device according to any of claims 3, 4 or 8 to 14, whereby

the at least two apertures (36) are arranged rotational-symmetrical to an optical axis(1) of the charged particle beam device.

16. Device according to any of the preceding claims, whereby

the at least one aperture of the aperture arrangement has a 4-fold symmetry shape.

17. Device according to claim 14, whereby

the at least one aperture of the aperture arrangement has a cross-like shape.

18. Device according to any of claims 14 to 15, whereby

the at least one aperture of the aperture arrangement has a cross-like shape formed by four connected elongated apertures.

19. Device according to any of the preceding claims, whereby

the aperture arrangement (26; 86a,b) comprises four apertures (36).

20. Device according to any of the preceding claims, further comprising

a spherical aberration correction element (52).

21. Device according to any of claims 7 to 8, further comprising

the spherical aberration correction element (52) is provided by an octopole element.

22. Device according to any of the preceding claims, whereby

the aperture arrangement (26; 86) is positioned between a source or virtual source (12) and a charged particle beam lens positioned closest to the source.

23. Device according to claim 22, whereby

the aperture arrangement is integrated in an anode or in an extractor.

24. Device according to any of the preceding claims, further comprising at least one feature from the group of:

a charged particle column length below 300 mm;

an optical system including the objective lens (18), whereby the optical system is arranged such that no crossover is generated;

an accelerating means for increasing the charged particle energy while traveling through the charged particle device and a decelerating means for decreasing the charged particle energy for impingement on a specimen; and

a control means for interaction optimizing the at least two independent charged particle beams.

25. Method of operating a charged particle beam device, comprising the steps of:

illuminating an aperture arrangement (26; 86) with at least one aperture (36) for blocking a part of the emitted charged particles, whereby the aperture arrangement forms a multi-area sub-beam charged particle beam

with a cross-section-area and a cross-section-circumference,

whereby a ratio between the cross-section-circumference and the cross-section-area is increased by at least 15% as compared to the ratio between a cross-section-circumference and a cross-section-area of a circular beam with the same cross-section-area as the multi-area sub-beam charged particle beam;

focusing the multi-area sub-beam charged particle beam with an objective lens (18) onto the same location of a specimen (19).

26. Method of operating a charged particle beam device according to claim 25, the illumination step comprises:

generating at least two independent charged particle beams;

27. Method of operating a charged particle beam device according to claim 26, whereby

the at least two independent charged particle beams are generated on a circle around an optical axis (1) of the charged particle device.

28. Method of operating a charged particle beam device according to any of claims 26 to 27, whereby

the at least two apertures are provided such that no significant interaction between the at least two independent charged particle beams occur.

29. Method of operating a charged particle beam device according to any of claims 25 to 28, whereby

the aperture arrangement is illuminated such that the at least one apertureis homogeneously eliminated.

30. Method of operating a charged particle beam device according to any of claims 26 to 29, further comprising the step:

interaction-optimizing each of the at least two independent charged particle beams.

31. Method of operating a charged particle beam device according to any of claims 25 to 30, whereby

the charged particles are energized to impinge on the specimen (19) with an energy below 3 keV.

32. Method of operating a charged particle beam device according to any of claims 25 to 31, further comprising the step:

correcting spherical aberrations, which are introduced by guiding parts of the multi-area sub-beam charged particle beam off-axis.

33. Method of operating a charged particle beam device according to any of claims 25 to 32, further comprising the step:

repeating imaging steps several times to generate a set of focus series measurements; and

generating a 3-dimensional image by superposing the set of focus series measurements.